

PROPOSED RECOMMENDATION CCTF NNN (2012):**Concerning the upgrade and calibration of GNSS equipment in the timing laboratories contributing to UTC towards multi-frequency, multi-constellation receiving systems**

The Consultative Committee for Time and Frequency,

realizing that

- atomic frequency standards have achieved unprecedented stability and accuracy, and that further advances in this field are underway,
- the ability to compare these standards for the realization of UTC is dependent on the accuracy and precision of GNSS time transfer;

considering that

- data from the Global Positioning System (GPS) satellites play an important role in time and frequency transfer,
- the GLONASS constellation is now complete and a modernization of the GLONASS system is underway,
- the European Galileo constellation was started to be deployed in 2011 and should reach a complete status in the coming years,
- The P. R. of China has already launched BeiDou/COMPASS satellites for regional applications, and the global constellation will be operational in the coming years,
- present uncertainties in the calibration of equipment at timing laboratories has a significant impact on international time transfer in general and on the accuracy of the computation of UTC in particular;
- GPS time transfer based on dual-frequency code and carrier-phase data is used in the operational computation of UTC for some time links,

noting that

- the costs associated with equipment acquisition, installation, operation, and maintenance are less than the purchase price of a single cesium frequency standard,
- many software algorithms using dual-frequency code and carrier-phase data are either available or under active development;
- some of these algorithms already allow for the combination of GPS and GLONASS data

recommends that

- the laboratories participating to UTC upgrade their equipment towards multi-frequency, multi-constellation receiving systems providing code and carrier-phase measurements,
- institutions currently developing software algorithms for time transfer work on the upgrade towards multi-constellation and multi-receiver solutions,
- the BIPM in collaboration with Regional Metrology Organizations (RMOs) develops calibration guidelines for new multi-frequency, multi-constellation equipment,
- the BIPM continues to organize and run campaigns to measure delays of this new GNSS equipment in laboratories, with the support of the Regional Metrology Organizations (RMOs) within the frame of regional comparisons,
- all laboratories, especially those playing a unique role in TAI computations, such as pivot laboratories and those contributing directly to Section 5 of the Circular T, be solicited to

supply data from at least three GNSS receivers traceable to their local realization of UTC; this would help verify the stability of their hardware delays.